

What is claimed is:

1. An optical disc apparatus for recording or playing back optical information on an optical disc, comprising:

5 a convergence lens for converging an optical beam that is irradiated on the optical disc;

a light detection unit operable to receive and detect the optical beam reflected by the optical disc on each divided area in a tracking direction, and output a first detection signal corresponding to a detected result from either one of the divided areas and a
10 second detection signal corresponding to a detected result from the other divided area;

a lens shifting unit operable to shift the light receiving area of the light detection unit in a tracking direction by shifting the convergence lens in the tracking direction;

15 an amplifying unit operable to change a gain balance by amplifying the first and the second detection signals using independent gains respectively;

an addition unit operable to output an addition signal by adding the first detection signal to the second detection signal in response to the shift in lens position of the convergence lens and the
20 change in gain balance made by the lens shifting unit and the amplifying unit; and

a gain balance adjustment unit operable to obtain the addition signal outputted from the addition unit, specify a gain
25 balance that equalizes detection sensitivities of the respective areas in the light detection unit based on the obtained result, and control the amplifying unit so as to have the amplifying unit amplify the first and the second detection signals using the determined gain balance.

30 2. The optical disc apparatus according to Claim 1, wherein the gain balance adjustment unit specifies a predetermined gain balance as a gain balance that equalizes

detection sensitivities of the respective areas in the light detection unit in the case where an addition signal becomes constant when a lens position shifts in the predetermined gain balance.

5 3. The optical disc apparatus according to Claim 2, further comprising:

 a lens position adjustment unit operable to obtain the addition signal outputted from the addition unit, specify a lens position that equalizes sizes of the respective areas for receiving
10 optical beam in the light detection unit based on an obtained result, and control the lens shifting unit so that the convergence lens shifts to the determined lens position.

 4. The optical disc apparatus according to Claim 3,
15 wherein the lens position adjustment unit specifies the predetermined lens position as a lens position that equalizes sizes of the respective areas for receiving optical beam in the light detection unit in the case where an addition signal becomes constant when a gain balance changes at the predetermined lens position.

20 5. The optical disc apparatus according to Claim 4,
 wherein the lens position adjustment unit specifies the predetermined lens position as a lens position that equalizes sizes of the respective areas for receiving optical beam in the light detection
25 unit in the case where a change rate of the addition signal on a gain balance becomes "0" at the predetermined lens position.

 6. The optical disc apparatus according to Claim 5,
 wherein the amplifying unit changes a gain balance so that an
30 addition result of a gain of the first detection signal and a gain of the second detection signal becomes constant.

7. The optical disc apparatus according to Claim 5,
wherein the amplifying unit changes a gain of either one of
the first detection signal or the second detection signal.

5 8. The optical disc apparatus according to Claim 4,
wherein the amplifying unit changes the gain balance to a first
and a second gain balances, and

the lens position adjustment unit shows a relation between a
lens position and an addition signal in the first gain balance with
10 function approximation, shows a relation between a lens position
and an addition signal in the second gain balance with function
approximation, and specifies a lens position shown by an
intersection of both functions as a lens position that equalizes the
sizes of the respective areas for receiving the optical beam in the
15 light detection unit.

9. The optical disc apparatus according to Claim 3, further
comprising:

a subtraction unit operable to output a subtraction signal by
20 calculating the difference between the first detection signal and the
second detection signal whose gain balance is adjusted by the gain
balance adjustment unit;

a subtraction signal amplifying unit operable to amplify the
subtraction signal;

25 a gain adjustment unit operable to change the gain of the
subtraction signal amplifying unit in response to the addition signal
outputted from the addition unit; and

a tracking control unit operable to control the lens shifting
unit so that optical beam can follow the tracks of the optical disc
30 based on the subtraction signal amplified by the subtraction signal
amplifying unit.

10. The optical disc according to Claim 2,
wherein the gain balance adjustment unit specifies the predetermined gain balance as the gain balance that equalizes the detection sensitivities in the respective areas in the light detection unit in the case where a change rate of the addition signal on the lens position becomes "0" in the predetermined gain balance.
11. The optical disc apparatus according to Claim 2,
wherein the lens shifting unit shifts the convergence lens to a first and a second lens positions,
the gain balance adjustment unit shows a relation between a gain balance and an addition signal in the first lens position with function approximation, shows a relation between a gain balance and an addition signal in the second lens position with function approximation, and specifies a gain balance shown by an intersection of both functions as a gain balance that equalizes the detection sensitivities of the respective areas in the light detection unit.
12. The optical disc apparatus according to Claim 1, further comprising:
a subtraction unit operable to output a subtraction signal by calculating a difference between the first detection signal and the second detection signal whose gain balance is adjusted by the gain balance adjustment unit; and
a lens position adjustment unit operable to specify a lens position that equalizes sizes of the respective areas for receiving optical beam in the light detection unit based on the subtraction signal outputted from the subtraction unit, and control the lens shifting unit so that the convergence lens shifts to the determined lens position.

13. An optical disc apparatus for recording or playing back optical information on an optical disc, comprising:

a convergence lens for converging optical beam that is irradiated on the optical disc;

5 a light detection unit operable to receive and detect the optical beam reflected by the optical disc on each divided area in a tracking direction, and output a first detection signal corresponding to a detected result from either one of the divided areas and a second detection signal corresponding to a detected result from the
10 other divided area;

a lens shifting unit operable to shift a light receiving area in the light detection unit in a tracking direction by shifting the convergence lens in the tracking direction;

an amplifying unit operable to change a gain balance by
15 amplifying the first and the second detection signals using independent gains respectively;

an addition unit operable to output an addition signal by adding the first detection signal to the second detection signal in response to the shift in lens position of the convergence lens and the
20 change in gain balance made by the lens shifting unit and the amplifying unit; and

a lens position adjustment unit operable to obtain the addition signal outputted from the addition unit, specify a lens position that equalizes sizes of the respective areas in the light
25 detection unit for receiving optical beam based on an obtained result, and control the lens shifting unit so that the convergence lens shifts to the determined lens position.

14. The optical disc apparatus according to Claim 13,

30 wherein the lens position adjustment unit specifies the predetermined lens position as the lens position that equalizes the sizes of the respective areas for receiving optical beam in the light

detection unit in the case where the addition signal becomes constant when the gain balance changes in the predetermined lens position.

5 15. A control device for controlling an optical head of an optical disc apparatus for recording or playing back optical information on the optical disc,

wherein the optical head comprises:

a convergence lens for converging optical beam that is
10 irradiated on the optical disc;

a light detection unit operable to receive and detect the optical beam reflected by the optical disc on each divided area in a tracking direction, and output a first detection signal corresponding to a detected result from either one of the divided areas and a
15 second detection signal corresponding to a detected result from the other divided area; and

a lens shifting unit operable to shift a light receiving area in the light detection unit in a tracking direction by shifting the convergence lens in the tracking direction;

20 the control device comprises:

an amplifying unit operable to change a gain balance by amplifying the first and the second detection signals using independent gains respectively;

an addition unit operable to output an addition signal by
25 adding the first detection signal to the second detection signal in response to the shift in lens position of the convergence lens and the change in gain balance made by the lens shifting unit and the amplifying unit; and

a gain balance adjustment unit operable to obtain the
30 addition signal outputted from the addition unit, specify a gain balance that equalizes detection sensitivities of the respective areas in the light detection unit based on an obtained result, and control

the amplifying unit so as to have the amplifying unit amplify the first and the second detection signals using the determined gain balance.

16. The control device according to Claim 15,

5 wherein the gain balance adjustment unit specifies the predetermined gain balance as a gain balance that equalizes the detection sensitivities of the respective areas in the light detection unit in the case where the addition signal becomes constant when the lens position changes in the predetermined gain balance.

10 17. The control device according to Claim 16, further comprising:
a lens position adjustment unit operable to obtain the addition signal outputted from the addition unit, specify the lens position that equalizes sizes of the respective areas for receiving
15 optical beam in the light detection unit based on the obtained result, and control the lens position adjustment unit operable to control the lens shifting unit so that the convergence lens shifts to the determined lens position.

20 18. The control device according to Claim 17,

wherein the lens position adjustment unit specifies the predetermined lens position as lens position that equalizes the sizes of the respective areas for receiving optical beam in the light detection unit in the case where the addition signal becomes
25 constant when the gain balance changes at the predetermined lens position.

19. The control device according to Claim 18,

30 wherein the lens position adjustment unit specifies the predetermined lens position as the lens position that equalizes the sizes of the respective areas for receiving optical beam in the light detection unit in the case where a change rate of the addition signal

on the gain balance becomes "0" at the predetermined lens position.

20. The control device according to Claim 19,

wherein the amplifying unit changes the gain balance so that
5 an addition result of a gain of the first detection signal and a gain of
the second detection signal becomes constant.

21. The control device according to Claim 19,

wherein the amplifying unit changes a gain of either one of
10 the first detection signal or the second detection signal.

22. The control device according to Claim 18,

wherein the amplifying unit changes the gain balance to the
first and the second gain balances,

15 the lens position adjustment unit shows a relation between a
lens position and an addition signal in the first gain balance with
function approximation, shows a relation between a lens position
and an addition signal in the second gain balance with function
approximation, and specifies a lens position shown by an
20 intersection of both functions as a lens position that equalizes the
sizes of the respective areas for receiving optical beam in the light
detection unit.

23. The control device according to Claim 17, further comprising:

25 a subtraction unit operable to output a subtraction signal by
calculating a difference between the first detection signal and the
second detection signal whose gain balance is adjusted by the gain
balance adjustment unit;

a subtraction signal amplifying unit operable to amplify the
30 subtraction signal;

a gain balance adjustment unit operable to change the gain of
the subtraction signal amplifying unit in response to the addition

signal outputted from the addition unit; and

a tracking control unit operable to control the lens shifting unit so that optical beam can follow the tracks of the optical disc based on the subtraction signal amplified by the subtraction signal amplifying unit.

24. The control device according to Claim 16,

wherein the gain balance adjustment unit specifies the predetermined gain balance as the gain balance that equalizes the detection sensitivities of the respective areas in the light detection unit in the case where a change rate of the addition signal on the lens position becomes "0" in the predetermined gain balance.

25. The control device according to Claim 16, further comprising:

a shifting control unit operable to control the lens shifting unit so that the convergence lens shifts to a first and a second lens positions;

wherein the gain balance adjustment unit shows a relation between a gain balance and an addition signal in the first lens position with function approximation, shows a relation between a gain balance and an addition signal in the second lens position with function approximation, and specifies a gain balance shown by an intersection of both functions as a gain balance that equalizes the detection sensitivities in the respective areas of the light detection unit.

26. The control device according to Claim 15, further comprising:

a subtraction unit operable to output a subtraction signal by calculating a difference between the first detection signal and the second detection signal whose gain balance is adjusted by the gain balance adjustment unit; and

a lens position adjustment unit operable to specify a lens

position that equalizes the sizes of the respective areas for receiving optical beam in the light detection unit based on the subtraction signal outputted from the subtraction unit, and control the lens shifting unit so that the convergence lens shifts to the determined
5 lens position.

27. A control device for controlling an optical head of an optical disc apparatus for recording or playing back optical information on the optical disc,
10 wherein the optical head comprises:
a convergence lens for converging optical beam that is irradiated on the optical disc;
a light detection unit operable to receive and detect the optical beam reflected by the optical disc on each divided area in a tracking direction, and output a first detection signal corresponding
15 to a detected result from either one of the divided areas and a second detected signal corresponding to a detected result from the other divided area; and
a lens shifting unit operable to shift a light receiving area in the light detection unit in a tracking direction by shifting the
20 convergence lens in the tracking direction;
the control device comprises:
an amplifying unit operable to change a gain balance by amplifying the first and the second detection signals using
25 independent gains respectively;
an addition unit operable to output an addition signal by adding the first detection signal to the second detection signal in response to the shift in lens position of the convergence lens and the change in gain balance by the lens shifting unit and the amplifying
30 unit; and
a lens position adjustment unit operable to obtain the addition signal outputted from the addition unit, specify a lens

position that equalizes the sizes of the respective areas for receiving optical beam in the light detection unit based on the obtained result, and control the lens shifting unit so that the convergence lens shifts to the determined lens position.

5

28. The control device according to Claim 27,

wherein the lens position adjustment unit specifies the determined lens position as a lens position that equalizes the sizes of the respective areas for receiving optical beam in the light
10 detection unit in the case where the addition signal becomes constant when the gain balance changes at the determined lens position.

29. A control signal generation circuit that generates a control
15 signal for controlling an optical head of an optical disc apparatus for recording or playing back optical information on an optical disc,
wherein the optical head comprises:

a convergence lens for converging optical beam that is irradiated on the optical disc; and

20 a light detection unit operable to receive and detect the optical beam reflected by the optical disc on each divided area in a tracking direction, and output a first detection signal corresponding to a detected result from either one of the divided areas and a second detected signal corresponding to a detected result from the
25 other divided area;

the control signal generation circuit comprises:

an amplifying unit operable to change a gain balance by amplifying a first and a second detection signals using independent gains respectively; and

30 an output unit operable to add the first detection signal to the second detection signal in response to changes in gain balance made by the amplifying unit, calculates a difference between the first

detection signal and the second detection signal, and outputs the control signal according to both of an operation results.

30. The control signal generation circuit according to Claim 29,
5 wherein the amplifying unit changes a gain of either one of the first detection signal and the second detection signal.

31. The control signal generation circuit according to Claim 29,
wherein the amplifying unit changes the gain balance so that
10 the addition result of the gain to the first detection signal and the gain to the second detection signal becomes constant.

32. A control method for controlling an optical head of an optical disc apparatus for recording or playing back optical information on
15 an optical disc,

wherein the optical head comprises:

a convergence lens for converging optical beam that is irradiated on the optical disc;

a light detection unit operable to receive and detect the
20 optical beam reflected by the optical disc on each divided area in a tracking direction, and output a first detection signal corresponding to a detected result from either one of the divided areas and a second detection signal corresponding to a detected result from the other divided area; and

25 a lens shifting unit operable to shift a light receiving area in the light detection unit in a tracking direction by shifting the convergence lens in the tracking direction;

the control method comprising:

a gain balance changing step of changing the gain balance by
30 amplifying the first and the second detection signals using independent gains respectively;

a lens shifting step of changing light receiving area in the light

detection unit by shifting in a tracking direction by shifting the convergence lens in the tracking direction;

an addition signal outputting step of outputting an addition signal by adding the first detection signal to the second detection
5 signal in response to the shift in lens position and the change in gain balance in the gain balance changing step and the lens shifting step; and

a gain balance adjustment step of specifying the gain balance that equalizes the detection sensitivities of the respective areas in
10 the light detection unit based on the addition signal outputted in the addition signal outputting step, and amplifies the first and the second detection signals using the determined gain balance.

33. The control method according to Claim 32, further
15 comprising:

a gain balance rechanging step of rechanging the gain balance by amplifying the first and the second detection signals using independent gains respectively based on the gains on the
20 respective first and second detection signals in the gain balance adjusted in the gain balance adjustment step;

a lens position rechanging step of changing light receiving area in the light detection unit in the tracking direction by reshifting the convergence lens in the tracking direction;

an addition signal reoutputting step of outputting the addition
25 signal by adding the first detection signal to the second detection signal in response to the shift in lens position of the convergence lens and the change in gain balance in the gain balance rechanging step and the lens position rechanging step; and

a lens position adjustment step of shifting the convergence
30 lens to the determined lens position by specifying the lens position that equalizes sizes of the respective areas for receiving optical beam in the light detection unit based on the addition result

outputted in the addition signal reoutputting step.

34. The control method according to Claim 32, further comprising:

- 5 a lens position adjustment step of shifting the convergence lens to the determined lens position by specifying the lens position that equalizes sizes of the respective areas for receiving optical beam in the light detection unit based on the addition signal outputted in the addition signal outputting step.

10